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BRIEFER ARTICLES.

TERMINOLOGY OF THE SPORE-STRUCTURES IN THE UREDINALES.[1]

SOME time ago I began to study groups of species among the rusts in a more methodical way than usually pursued, and as part of the method undertook to prepare uniform descriptions in which like parts of each structure should receive the same kind of treatment in every case. I soon met with an obstacle that had not been anticipated. The terminology in use was found to be clumsy, ambiguous, poorly correlated, and quite inadequate to show homologies properly.

I will illustrate a few of the difficulties which confronted me. When an aecidium is mentioned, there is a tolerably clear conception of a cup-like structure filled with spores; but when one reaches the next stage of the rust, what is the meaning conveyed by the word uredo? I think it is most generally employed as a collective term, referring to the second stage of the rust. We can properly say that the uredo occurs on leaves of a certain host, but if we wish to specify a single uredinial structure corresponding to an aecidium, it is necessary to say uredosorus; and yet it is not permissible to say aecidiosorus. Passing to the third stage of the rust there appears to be neither a specific nor a collective name with which to designate it. The nearest approach to a specific term analogous to aecidium is teleutosorus, and to a collective term analogous to uredo is teleutostage. We can say properly that aecidia appeared on a leaf, after a time they were followed by the uredo, and finally the teleutospore stage was developed; in which statement we have used three different methods to express the same idea relative to similar spore-structures.

Taking up the first stage again, there appears to be nothing inappropriate in calling the single spore-structure an aecidium so long as we have in mind the first stage of species belonging to the genus Puccinia or Uromyces; but in the genus Phragmidium there is no peridium present, and in Gymnoconia not only is the peridium absent but the spore-layer is extended and indefinite, and the term aecidium now seems far less applicable. For such cases it is customary to call the structure a caeoma, instead of an aecidium, adopting the generic name established by TULASNE in 1854, who applied it to forms without a peridium and having the spores in chains. But in the genus Coleosporium it is the uredostage, and not the aecidium, that possesses the caeoma structure. Moreover, care must be exercised not to confound TULASNE's caeoma with LINK's caeoma. For in 1809 LINK established a genus Caeoma to cover pulverulent forms of rust, whether the spores were borne singly or in chains, which was extensively used by mycologists of the time and subsequently, including SCHWEINITZ and others in America. But the terminology for the first stage of a rust is not yet exhausted. If the stage occurs on a pomaceous host, one is usually safe in calling it a roestelia; and if on a coniferous host, it is usually styled a peridermium. But there are plenty of instances among the less common forms of rust where none of these many terms seems accurate.

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[1] Read before the American Mycological Society at Philadelphia, December 30, 1904.

Turning to the second stage of rusts fortunately we do not find so many terms in use. The spores are usually borne singly on pedicels, and are generally called uredospores, or when borne in chains they are caeomospores. If the sorus happens to be surrounded or filled with prominent paraphyses, the spores become epiteospores, although this term is derived from a generic name first applied to an aecidial form. It has seemed to me providential that when the uredosorus is surrounded by a peridium, as in species of Pucciniastrum and Cronartium, we are not required to have some other sort of spore, and are permitted to say simply uredospore.

I have only cursorily mentioned some of the most obtrusive difficulties encountered, when I undertook seriously to record comparative studies of the rusts. I should probably never have publicly rebelled against this confusion of superfluous and yet inadequate terms, had I not after a time become interested in generic nomenclature. So long as there seemed to be no impropriety in allowing a generic name to wear out and be cast aside, or to be subjected to the menial duty of designating a form of spore, it seemed unreasonable to make complaint. But when the conviction became firmly established that a uredineous genus was entitled to as much dignity of position as the genus in any other group of plants; and when it became evident, moreover, that in the application of the rule of priority some of these degraded genera might suddenly assume the place usurped by long accepted names, as for instance, KUNTZE would have us believe that Roestelia should take the place of Gymnosporangium, then I thought it time to look into the possibility of emending, changing, or in some way improving the terminology of the spore-forms. Pursuing my generic studies further, it appeared little short of absurd that one of the earliest genera, and until recently one of the largest, which has embodied the most prominent idea of the order both in the scientific mind and in the popular mind, and which supplied the accepted name by which the order is now known, I mean the genus Uredo, should be wholly discredited and abandoned, and according to many able mycologists even lose its rights in synonymy. When I came to believe that the names Uredo, Aecidium, Roestelia, Peridermium, Epitea, and Caeoma were entitled to rank as acceptable genera, provided they were not antedated, it became certain that these names should no longer be made to do duty as spore-names.

For the several reasons which I have now partially illustrated, I was impelled to seek for more serviceable, accurate, and concise names for uredineal spore-structures. More than a year ago I presented the first installment of my problem to Dr. FREDERIC E. CLEMENTS, of the University of Nebraska, and it is to his continued and hearty cooperation and suggestion that I am able to present at this time a well considered series of terms to designate the several spore-structures of the Uredinales. I think the claim can be justly made that these new terms, all constructed by Dr. CLEMENTS, will do away with ambiguity, have a definite and easily recognized application, permit of uniformity of statement for the several spore-stages, and promote clear conceptions of homologies.

The terms I have to propose apply to the sorus. By sorus is meant the structure which arises from a single, fertile hyphal mass, or hymenium, either with or without a peridium, now usually called spermogonium, aecidium, uredosorus, teleutosorus, or kindred names. A compound sorus is produced by a number of sori standing close together, separated and surrounded by modified hyphae, which form a stroma, erroneously termed paraphyses, *e. g.*, the teleutosori in *Puccinia rubigovera* and *Puccinia Virgaureae*. The stroma is not considered a part of the sorus, but an adjunct structure. A simple sorus is surrounded by the tissues of the host, or by unmodified mycelium, and includes the peridium, and all true paraphyses, whether peripheral or discal.

The new terms consist of four words, with their derivatives, one for each of the four stages of uredineal fungi. For the sorus of the initial stage, usually designated by a cipher, and called spermogonium, pycnidium, etc., I propose *pycnium* (πυκνίον); derivatives *pycnial*, *pycniospores*, etc. For the sorus of the first spore-stage, usually designated by the Roman numeral I, and called aecidium, roestelia, peridermium, etc., I propose *aecium* (αἰκίον); derivatives *aecial*, *aeciospore*, etc. For the sorus of the second spore-stage, usually designated by the Roman numeral II, and called uredosorus, etc., I propose *uredinium* (uredo); derivatives *uredinial*, *urediniospore* or if preferred *uredospore*, etc. For the sorus of the third spore-stage, usually designated by the Roman numeral III, and called teleutosorus, I propose *telium* (τέλιον); derivatives *telial*, *teliospore*, etc.

These four words and their derivatives have sufficient resemblance to corresponding terms now in use to suggest their meaning, and thus facilitate their introduction; and yet they are all new words and are now brought before the scientific public for the first time. All the words are shorter than the corresponding ones now in use, except urediniospore, which is longer by three letters than uredospore, but no more difficult to pronounce, and for this the word at present in use, uredospore, may well be retained. No permissible shortening of the stem of this term has seemed feasible, and yet have the uniformity and classicism of the series preserved.

I may be permitted to illustrate the use of these words by a similar sentence to that employed at the beginning of my paper. In the case of wheat rust, aecia appear on the leaves of the barberry in spring, preceded by pycnia; the aeciospores give rise in due course of time to uredinia on the wheat plant, followed by telia. A similar statement could be made for a Coleosporium, Phragmidium, or any other rust. One might explain the difference between the telial stage and the uredinial, or discuss the status of pycniospores as compared with teliospores or other sorts, or he might point out that the sorus of a uredinium has the same essential structure whether without peridium and stylosporic, as in Puccinia; with peridium and stylosporic, as in Pucciniastrum, or without peridium and the spores in chains, as in Coleosporium; and so on.

Finally, the acceptance of these terms would require that the following terminology for the receptacles, spores, etc., of the rusts should be substituted for the series recently given by SACCARDO in his *Nomenclatura mycologica*, viz., sorus, pycnium, aecium, uredinium, telium, peridium, stroma. Mesospore, amphispore, stylospore, etc., are special descriptive terms, which may be extended indefinitely as need arises, but do not form part of the general category. Caeomospore, epiteospore, aecidiospore, and other terms compounded from generic names should be wholly discontinued. Peridium is to be preferred to pseudoperidium, in accord with the usage of DECANDOLLE, LÉVEILLÉ, and many recent mycologists. Brevity, directness, and accuracy are excellent qualities to keep in mind when deciding upon terminology.—J. C. ARTHUR.

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